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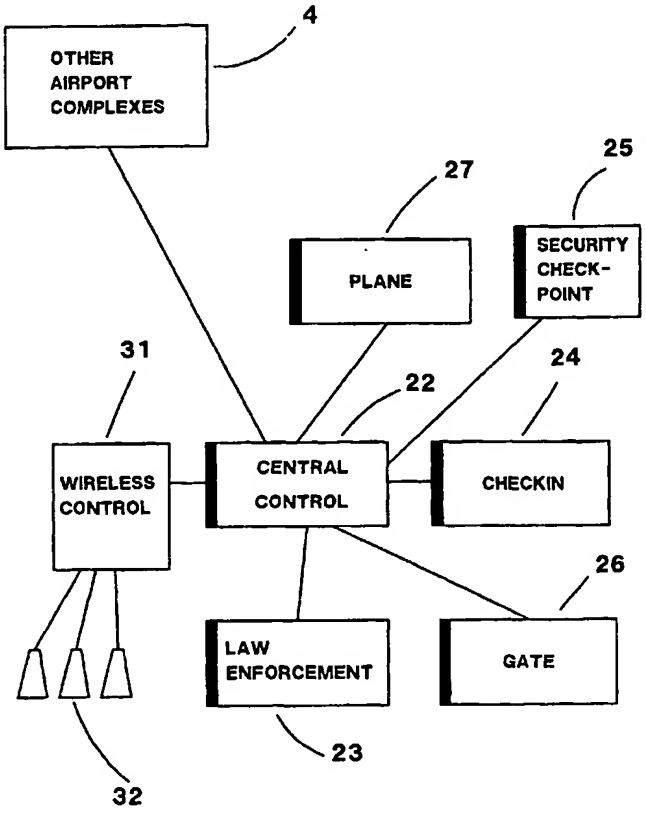
(54) Title: METHOD AND SYSTEM FOR AIRPORT SECURITY



(57) Abstract: A method and system for airport security where passengers or persons entering approach a check-in counter (24) and undergo positive identification (ID) by fingerprint scan, face scan, or other means of positive identification. The positive ID data and optional data about the person including a scan of a government supplied ID like a drivers license or passport is entered in a database (22) and checked against various law enforcement databases (23) for law enforcement interest in the person. The person is given a wireless card that also acts as a boarding pass. The person carries the card while in the airport. The system is notified when the person enters a secure gate area (26), boards or leaves an aircraft (27), etc. In addition, the system can determine if a person is carrying more than one smartcard or if a card has been abandoned.

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

Description

METHOD AND SYSTEM FOR AIRPORT SECURITY

Technical Field

This invention relates generally to airport security and in particular to a method and system for identifying and tracking a passenger or employee in and through airports in the world air transportation system.

Background Art

An identification badge is many times provided to employees of airports. Passengers however are usually identified only by a single photo identification that is presented at check-in. Security consists of a series of questions concerning baggage and tickets. No check is made on the identity of the passenger (except on international flights where a passport is requested). The passenger's location in the airport is not tracked. When the passenger checks into a flight, a boarding pass is presented and the passenger boards the aircraft. There is no verification that the same passenger who checked in is the one that boarded, and it is very easy for a boarded passenger to exit the aircraft after boarding without being noticed by anyone. Security at airports is minimal as to who a passenger is and where the passenger is in the airport.

Prior art systems have proposed electronic tickets and smartcards that can be carried by passengers. Tuttle in U.S. Patent 5,914,671 presents a system for locating an individual in a facility where a portable wireless transponder device is carried by the individual. Tuttle's device resembles a standard security badge with a possible photo of the individual on the badge. Tuttle's invention is directed toward location of employees who would wear such badges. Tuttle states that a passenger could also possess such an identification and be located. However, Tuttle makes no reference to any type of security checking of the individual.

Yokozawa et al. in U.S. Patent 5,740,369 present an information delivery system and portable information terminal where an individual possesses a smartcard type of wireless device and can be tracked by a wireless system. Yokozawa also describes a person passing through a check-in gate with the gate itself recognizing and communicating with the portable device by wireless means. While Yokozawa presents a wireless device carried by a passenger, There is no mention of the security aspects of the situation.

There are systems where passengers and/or employees carry wireless smartcards that communicate in data bases; however, none of these systems solve the security problem that exists at airports where potential passengers could be terrorists, criminals or other dangerous persons. They do not address the problem of whether a passenger actually boards a flight and remains on the plane, and whether the passenger actually arrives and exits a second or subsequent airport. In the current airport system and prior art systems, there is no connection or relationship between airline database information and security database information.

Disclosure of the Invention

The invention is a method and system for airport or building security where a passenger presents himself at the check-in counter in the normal way. A government generated picture identification is also presented (drivers license, passport, etc.). The invention then requires additional positive identification by fingerprint scan, face scan, face recognition, eye retina scan, voice scan, handprint, palmprint, finger length comparison, DNA, or some other means of positive identification. In addition, a new digital photo can be taken of the passenger during check-in. The total data thus acquired can be compared against law enforcement databases such as FBI or INTERPOL, etc. to determine immediately if the potential passenger is wanted or known to be dangerous. There needs to be no indication at the check-in counter if a positive identification is made of a

dangerous individual; rather, airport security personnel can be immediately notified.

After the identification process, the passenger can be checked into the flight and then given a wireless device that may be in the form of a smartcard, or other small wireless device that can be carried. This serves as a boarding pass and airport tracking device. The device can be a small, flat, card like a credit card, that can contain electronics and wireless communication capabilities. Since the location of this card wireless device can be tracked in the airport by wireless antenna location, by GPS, or by direction fixing between multiple antennas, or any other tracking means, the approximate location of the person is known at all times while in any area of the airport or building. In the case of a positive identification of a dangerous or wanted individual, law enforcement officials can apprehend the person anywhere in the airport or building that allows a safe and non-disruptive apprehension.

The system can also report back when the person has passed through carry-on security (normal X-ray, etc.), or any other security check point, when the person is in the departure gate area, and when the person has boarded an aircraft. At boarding, a second security check can be made with a second fingerprint, face scan, or retinal scan, or any other positive identification method to verify that the person who checked in originally is the one boarding the flight. The system can positively ascertain that the person boards a certain aircraft and stays on the aircraft. Egress can be controlled by the passenger having to present the smartcard to exit the aircraft.

In the rare case of someone having to legitimately leave an aircraft after boarding, airline personnel would be immediately notified by the card at egress to ascertain why the exit is being made, and to possibly assist the passenger (who might have gotten on the wrong plane, might be sick, etc.). An illegal or unexpected egress would be immediately noted by airport security personnel. It is also possible to continue to communicate with

the card inside the aircraft if the craft is also equipped with a wireless system. In addition, satellite communication can possibly be carried on with the aircraft and cards inside the aircraft while it is in flight or parked at a gate.

Upon arrival at a final or intermediate airport, a normal egress from the aircraft would be noted by the system in the new airport. The passenger's location could be tracked by the system to baggage pickup and airport exit, or until checkin and re-boarding a subsequent flight. When the passenger finally exited the final airport, the card could be collected and recycled for reuse, and the system would note that the person had left the system.

A major improvement of the invention over the prior art is the positive identification of every passenger and possibly every person entering an airport. The invention can provide positive tracking at all times as to the location of the person in the world air transportation system (all participating airports), and a final determination that an individual has arrived at a final destination and departed the system.

The invention could be optionally applied to all people in airports or any other building, including visitors, by also requiring them to register on entry, at least by fingerprint or face scan, or other ID, and also carry a wireless card while in the airport or building. Anyone who tried to leave an airport or building without a card could be stopped and re-identified (sometimes people might loose the card). A lost card could be located through wireless communication with the system.

A more sophisticated version of a card could be equipped with an LED display device where flight schedules could be called up, and an alarm that would buzz or otherwise indicate the approach of boarding time. The more sophisticated card could be connected into the internet for the convenience of the passenger so that the passenger could receive or send E-mail, get stock quotes, or generally surf the internet while waiting for the

flight. A buzz or audible alarm could sound if there was an important announcement coming in for that passenger such as a gate change, etc.

Brief Description of the Drawings

FIGURE 1 shows an embodiment of the present invention as a diagram of an airport showing important points in the security scheme.

FIGURE 2 shows a check-in arrangement.

FIGURE 3 shows a aircraft boarding gate with egress control.

FIGURE 4 shows a representative drawing of a possible smart-card along with LED display and audible alarm.

FIGURE 5 shows a block diagram of the relationships between the card, check-in, and security/law enforcement data bases.

Best Mode of Carrying Out the Invention

Figure 1 shows an airport where the invention is used as a passenger or personnel security system. Most airports contain an entry area or set of doorways (1) where people enter and leave the airport complex. An optional system check-in area (2) can be set up here if it is desired to control people entering and leaving the facility. If this station is used, a person entering the airport simply allows a fingerprint, face scan, or retinal scan to be taken at this point. People departing the airport or building must turn in cards at this point in order to egress.

Most airports are constructed with an airline check-in area with long counters where passengers are checked into flights. Figure 1 shows several such check-in counters (3). At these counters passengers queue up and wait to present their tickets

and baggage. This particular check-in point is where most data is entered into the system of the invention. When a passenger presents a ticket to an agent at this type of checkpoint, the passenger is required to also present some sort of government issued photo identification. Usually this is a driver's license or passport. At this point, the invention can be used to scan in the photo on the presented identification. Any special information about the passenger that is needed or desired by the airline can also be entered such as medical information, special food requirements and other information as may be needed by the airline. Normal seat assignment or check can be made at this point.

Here, the passenger is also required to submit to a positive identification check. This check can be in the form of a fingerprint scan, a face scan, face recognition, an eye retinal scan, a hand scan, a palmprint, a hand scan, a finger length scan, DNA check or any other positive identification method. At this point, the system can take a current photo of the passenger, and can present all the data to a computer data base. The data can be checked against Police, FBI, INTERPOL, immigration, customs, postal service, or other databases. If law enforcement databases are remote from the airport, the data can be transmitted by modem, LAN, WAN, internet, or any data transmission other method.

The passenger can then be handed a wireless card device and told to keep it on their person. They can also be told that it is their boarding pass. This card is a wireless device that can contain data and can be tracked for location throughout the airport complex. The passenger is also entered into the airline database in the normal way for flight check-in and possibly for weight and balance. The system contains antennas (32) for tracking the smartcard. These antennas (32) can be located in many places in the building or airport complex in question.

The passenger is then allowed to leave the check-in counter with the card as an electronic boarding pass and tracking system. If there has been any discrepancy in the identification given by

the passenger after checking the data against law enforcement databases, airport security officials can track the location of the bearer of the card anywhere in the airport. If there is sufficient cause, the passenger could be apprehended at a time and place determined by law enforcement or security officials.

Most airports are constructed with a baggage and carry-on security checkpoint (5) which usually contains X-ray equipment for checking carry-on bags and metal detectors (possibly explosive detectors) to check for weapons and dangerous material. In the present invention, this checkpoint (5) also can communicate by wireless means with any card nearby. As the passenger passes through this checkpoint, the system notes this progress. The card can be optionally hand read with a magnetic or any other type of reader. If the passenger subsequently leaves the secure gate area for any reason, this can be noted.

Once in the gate area (6), the passenger approaches the flight departure gate and passes another checkpoint (7). Here again the system notes the location of the passenger and the fact the he is actually boarding an aircraft. A database check can be made to assure it is the correct aircraft, and if wrong, airline personnel can be immediately notified. At this aircraft boarding checkpoint (7), a second positive identity check can be optionally performed such as taking another fingerprint, face scan, retinal scan, etc. again. While this second scan is optional, it enhances security because it can be positively determined if the correct individual is boarding the aircraft.

If a passenger tries to leave an aircraft after successful boarding, the card can be immediately detect this, and airline personnel and, if necessary, security personnel, can be notified. Since there may be legitimate reasons a passenger might deplane (sickness, trying to make a phone call, simply changed mind about traveling, etc.), airline personnel should make sure at this point the reason. One major difference between the present invention and the prior art is that with the present invention, the fact that the passenger has left the airplane is immediately

known.

The invention can also determine if a person is carrying more than one card, or if a card has been lost. This is very useful in making sure that passengers on planes are the ones who should be there, and that passengers actually take the flight are supposed to. If someone tries to deplane without a card in their possession an alarm could be set off or security personnel could be notified. This is easily accomplished since there could be an alarm at the plane entry and exit point (7) that detects anyone trying to pass through. A quick interrogation of the person's card could prevent the actual ringing of an alarm while still alerting airline personnel.

Figure 2 shows a side view of an airline check-in station using the invention. There is a counter (8) commonly found at airports with some means for checking in baggage (not shown) and for assigning or checking seating. There can also be a standard computer terminal (11); however this terminal can connect to the card system software of the invention which prompts the operator for specific information required to be entered as well as optional information. In addition, this terminal (11) can allow normal entry of airline passenger check-in data.

The check-in station can contain a positive identification device (9) which can be a fingerprint scanner, face scanner, camera, eye retinal scanner, DNA scanner, hand scanner, palmprint scanner, finger length scanner, or any other means that may exist now or in the future for positive identification of an individual. The station is also equipped with a camera (10) which can be a digital still photo camera, a TV camera, or any other type of camera or image generation device. The station can also contain a document scanner (28) for scanning in the identification presented by the passenger.

During check in, the passenger approaches the check-in station counter (8) in the normal way. A government generated, photo identification such as a drivers license or passport is

presented by the passenger and scanned using the scanning device (28) provided in the station. A digital photo can be taken with the camera (10), and a positive identification can be made with the positive identification device (9).

After this data is taken, it is entered into the database of the system. From here it can be transmitted or compared against law enforcement, immigration, or customs information to determine if the individual is wanted, or is a threat in any way, or if there is any other law enforcement interest. After normal airline check-in, the passenger is presented with a wireless card to carry. This card is equipped with a transponder so that it can be tracked and located anywhere in the airport.

Figure 3 shows a typical airport gate area. There is an entrance security port (15) which contains the standard carry-on and personal security checks (x-ray and metal detector). In addition however, the system can contain a wireless card interface located at this security gate. As the passenger passes through this security portal into the secure gate area, the portal (15) can send an optional message to the card digitally marking it as to the fact that the passenger is now in the gate area (12) as well as entering the fact in the database. A similar portal (without carry-on check) (14) can be located at the aircraft doorway so that when the passenger actually enters the aircraft (13), the card can again be digitally marked indicating the passenger is actually aboard the aircraft. An optional positive identification could be made at this point with an optional second positive identification device (29) to assure that the correct person has boarded.

In addition, optionally, the wireless communication can be continued on into the aircraft if the craft is equipped with wireless communications capability. The aircraft's security system could thus also maintain satellite communication with the rest of the system at all times including when the aircraft is in flight.

The invention allows tracking of the passenger from the non-secure part of the airport into the secure gate area, and finally onto the aircraft by various antennas (32) located throughout the facility or airport. Upon arrival at a different airport, the invention allows tracking of the passenger from the aircraft (13) into the secure gate area (12) out of that area to a baggage area or to another transfer aircraft, and either out of the airport or onto a second aircraft.

Figures 4A and 4B show replicas of a "smart" type card (16) which is one embodiment of a hand carried wireless device. The model in Fig. 4A is a simple card used for identification only. This model contains a processor and wireless transponder (17) embedded in the card. An antenna (18) can also be embedded in the card as well as a battery (30). The processor can also contain optionally RAM or ROM memory. Various programs or processes can be used with the card (16). The processor can be a microprocessor or microcontroller or any other processor device. Memory can be internal or external to the processor.

Figure 4B shows a more sophisticated version of a "smart" card (16). Here, in addition to the features described in relation to the smartcard shown in Fig. 4A, the card can contain a display (19), a microphone/speaker (20), a miniature mouse (21) and other features needed to transmit, receive, and/or display information.

The advanced card (16) of Figure 4B can in addition to providing basic security tracking, display flight information, information from the internet, stock prices, news headlines or stories, or any other type of information that might be of interest to the passenger. In addition, the advanced card of Fig. 4B could also be used to play various games using the mouse device (21). A different version could also contain a cellular telephone (not shown).

Tracking of the card (16) within the airport can always be accomplished using a series of local antennas within the build-

ing. Normal burst transponding techniques can be used. Any type of wireless method of handling multiple stations can be used including spread-spectrum, bluetooth wireless, or any other wireless methods. Transmission between airport antennas and the card (16) can be radio frequency or optical, including infrared, continuous, packet, burst, or any other means using time-division multiplex, frequency division multiplex, code division multiplex, ATM, or any other communication method. Modulation can AM, FM, PM, using any type of PCM or data communications technique or combination of these methods including QAM and QPSK, or any other modulation technique. In addition error correcting codes and retransmission techniques can be used to assure data integrity.

Figure 5 shows the logical relationships between the various possible components of the invention. A central control and database (22) can be a mainframe, personal computer, or any other type of computer system. This central control is connected by modem, LAN, WAN, internet, or any other communications means to law enforcement, immigration/customs and/or motor vehicle data bases (23) for identification verification and determining if a given individual is of any interest to law enforcement officials. The central control (22) is also connected by cable, LAN, WAN, modem, wireless, or by any other connection means to check-in points (24) where airline personnel check in passengers, security check points (25), boarding gates 26, and other points in the airport including parked aircraft (27). In addition to the links shown, the central control point (22) for a given airport can be connected to control points for other airports (4) or to a master control point for a country or even the entire world. Communications can continue into the interior of aircraft, even aircraft in flight with satellite communications.

The central control point (22) can also be connected to a wireless communication system controller (31) within an airport or building. This wireless controller (31) is connected to a number of antennas (32) located throughout the airport or building.

Position location can be accomplished by using signal strength to determine the nearest antenna to the card in question, direction fixing by multiple antennas, or GPS techniques where a GPS receiver is incorporated into the card. No matter how position is determined, the present invention requires resolution to at least major location areas within an airport. The higher the position resolution, the better; however, the system can run with minimum position resolution as long as position is known well enough for security personnel to find a person in an airport or building area.

In the case where multiple airports or buildings are linked into a single system, passengers with cards can be tracked from airport to airport around the world from the time a passenger first enters an airport to the time the passenger leaves the airport system at a final destination, including tracking of passengers aboard aircraft in flight using satellite communication techniques. In addition, the system of the present invention can track airport employees both full time and part time or temporary, and baggage if a card is attached to baggage.

Industrial Applicability

The invention provides a method and system for tracking people in the world air transport system. It is thus very useful for determining if a criminal or terrorist is in an airport or attempting to board a plane. It also provides a method for determining when a passenger makes attempts to leave an aircraft after boarding. Because of the demand for increased security at airports, the invention finds immediate application.

Claims

1. A method of airport security comprising the steps of:

identifying a passenger at check-in time using a method of positive identification to provide identification data;

entering said identification data into an airport security controller;

comparing said identification data against at least one law enforcement database;

issuing said passenger a wireless device, said wireless device containing a transponder such that said passenger's location can be tracked in said airport;

stopping said passenger when said identification check against said law enforcement database indicates security interest.

2. The airport security method of claim 1 where said identification method is by fingerprint or face scan.

3. The airport security method of claim 1 further comprising the step of verifying when said passenger has entered a secure gate area.

4. The airport security method of claim 1 further comprising the step of verifying when said passenger has boarded an aircraft.

5. The airport security method of claim 4 further comprising the step of notifying security personnel if said passenger leaves an aircraft.

6. An airport security system comprising at least one database containing law enforcement data on individuals, at least one positive identification means, at least one check-in location,

and a plurality of portable wireless devices capable of wireless communication with said check-in location, and a check-in process with the steps of:

making a positive identification of each passenger at the check-in location;

comparing the positive identification against data in the law enforcement database;

issuing said passenger one of the wireless devices;

tracking a location of said passenger in an airport using wireless capability contained in the wireless device;

stopping said passenger if the law enforcement database indicates law enforcement interest in that passenger.

7. The airport security system of claim 6 where the positive identification is made with fingerprint or face scan.

8. The airport security system of claim 6 where security personnel are notified when the passenger boards of leaves an aircraft.

9. The airport security system of claim 6 where security personnel are notified when the passenger enters or leaves a secure gate area.

10. The airport security system substantially as described and/or illustrated in the specification.

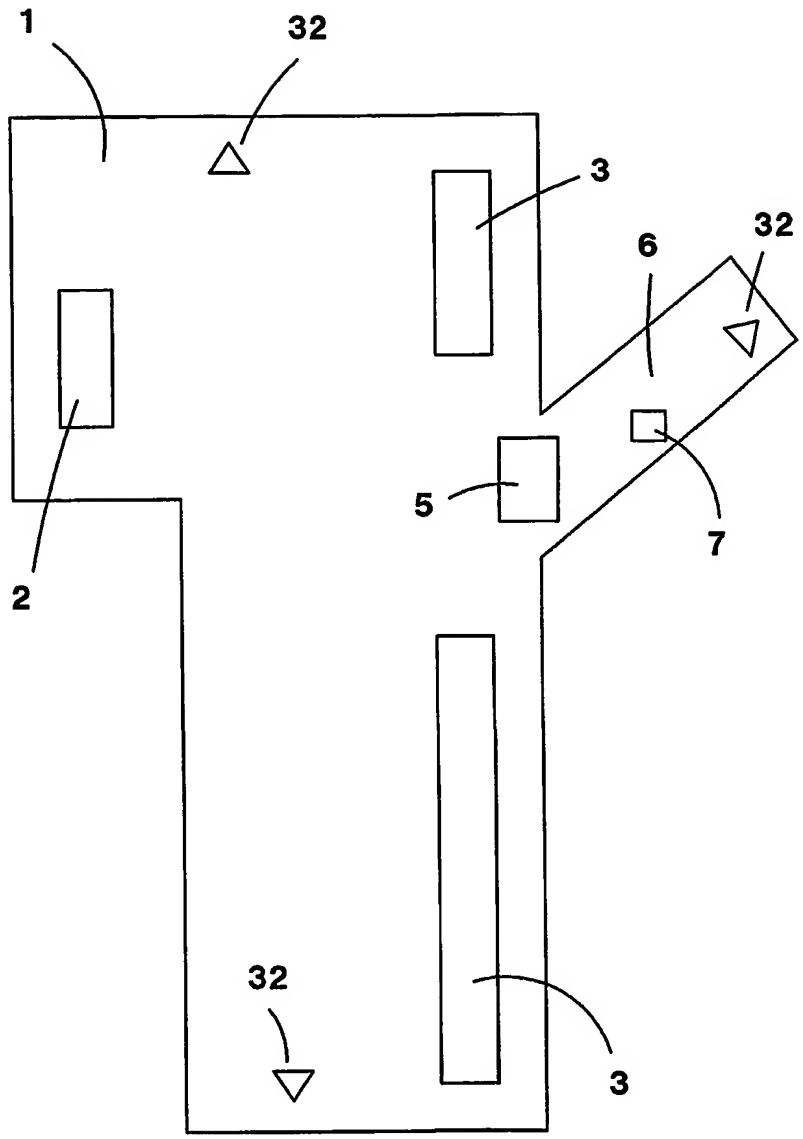

FIG. 1

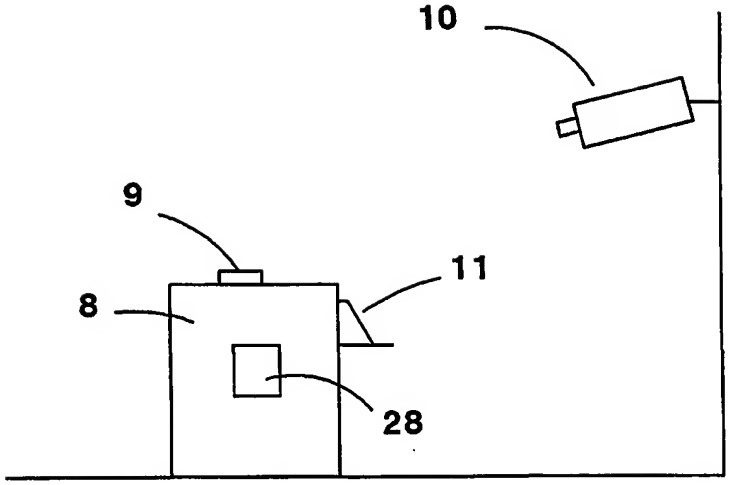

FIG. 2

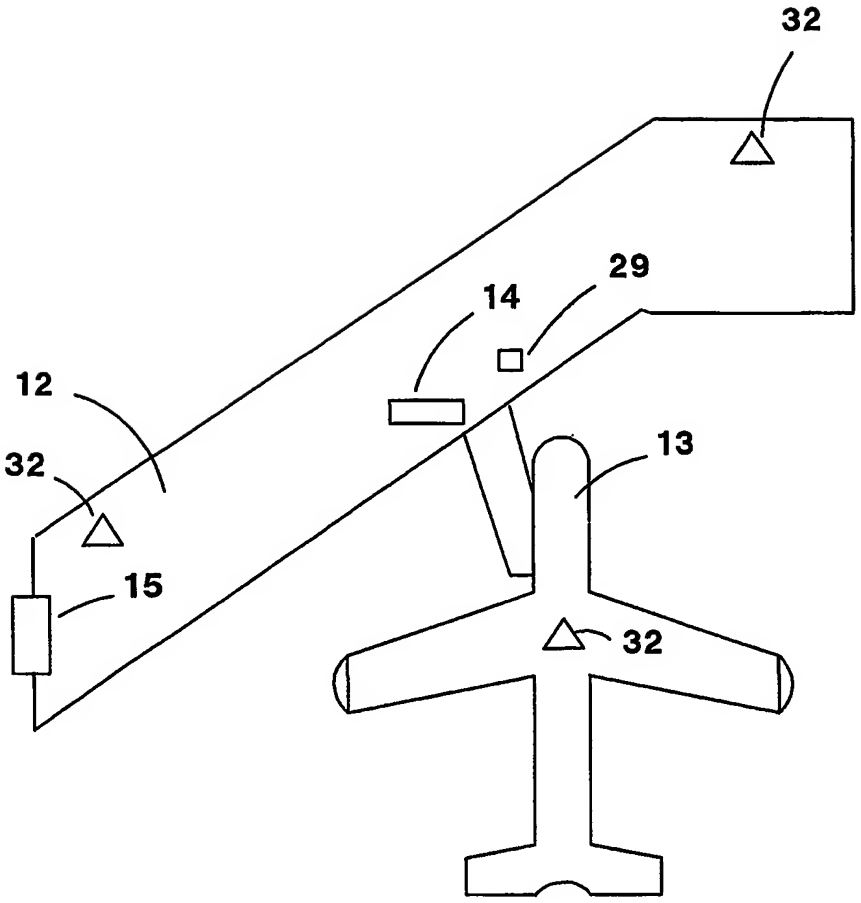

FIG. 3

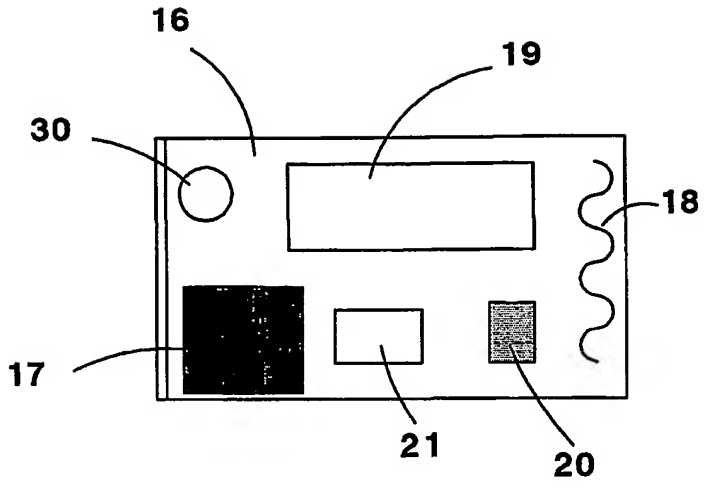

FIG. 4B

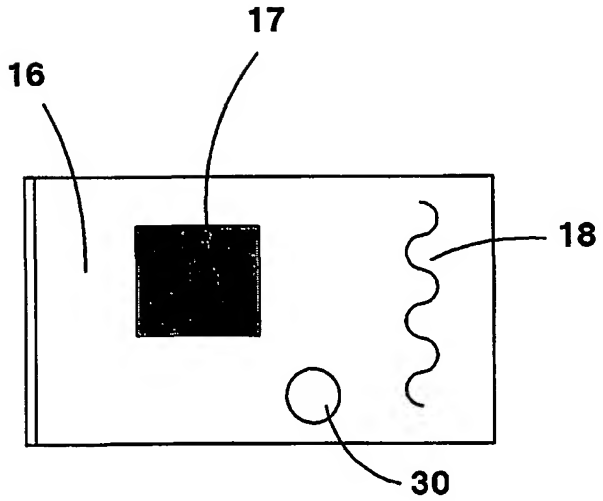

FIG. 4A

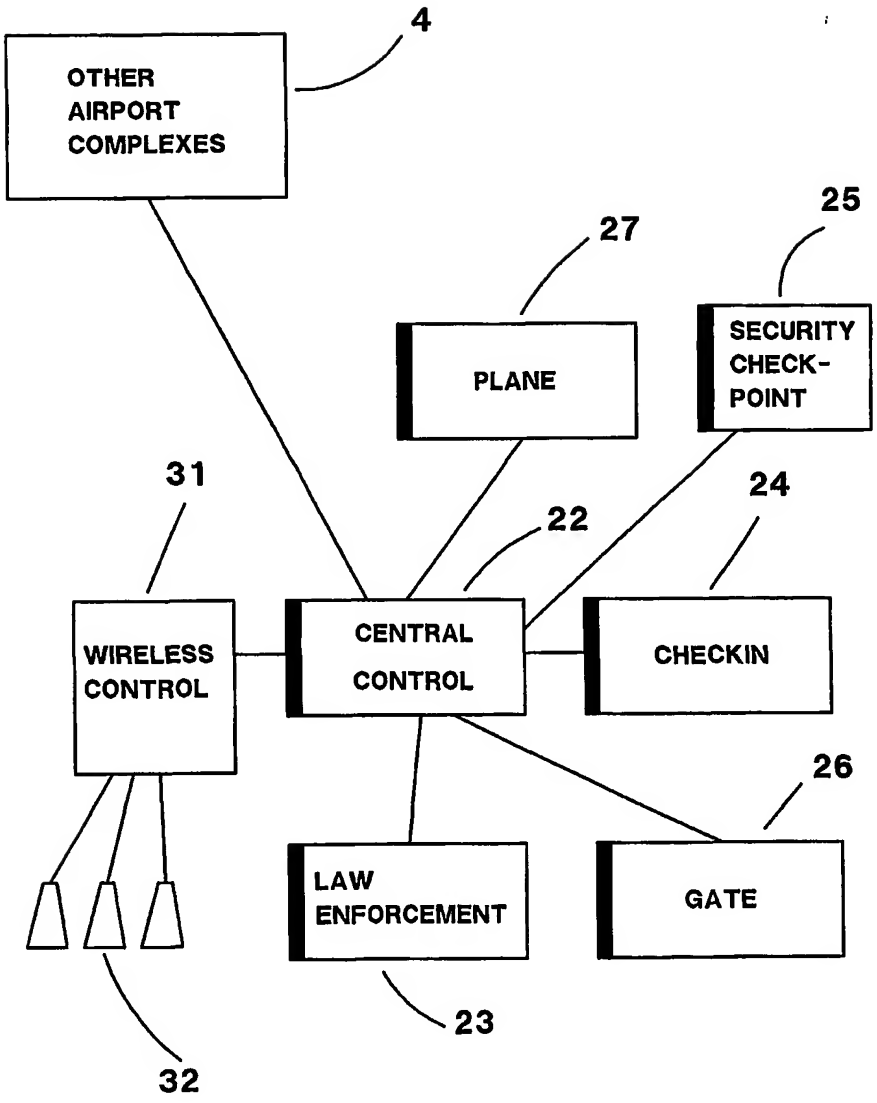
4
OTHER AIRPORT COMPLEXES
27
PLANE
25
SECURITY CHECK-POINT
31
22
24
WIRELESS CONTROL
CENTRAL CONTROL
CHECKIN
26
LAW ENFORCEMENT
GATE
23
32

FIG. 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US01/29647

A. CLASSIFICATION OF SUBJECT MATTER
IPC(7) :G08B 23/00
US CL :340/573.1
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED
Minimum documentation searched (classification system followed by classification symbols)
U.S. : 340/573.1, 825.54, 10.1, 506, 539; 455/88, 95, 100; 235/384

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
BRS

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5,914,671 A (TUTTLE) 22 June 1999, see entire document	1-10
A	US 6,085,976 A (SEHR) 11 July 2000, see entire document	1-10
A	US 5,982,281 A (LAYSON, JR.) 09 November 1999, see entire document	1-10
A,P	US 6,127,917 A (TUTTLE) 03 October 2000, see entire document	1-10
A,P	US 6,229,445 B1 (WACK) 08 May 2001, see entire document	1-10
A,P	US 6,246,320 B1 (MONROE) 12 June 2001, see entire document	1-10

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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Date of the actual completion of the international search 05 NOVEMBER 2001	Date of mailing of the international search report 05 DEC 2001
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